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Doping evolution of itinerant magnetic fluctuations in Fe-based pnictides

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Abstract

Employing the four-band tight-binding model, we study theoretically the doping dependence of the spin response in the normal state of novel Fe-based pnictide superconductors. We show that the commensurate spin density wave (SDW) transition that arises due to interband scattering between the hole α-pockets and the electron β-pockets disappears already at the doping concentration x≈0.04 reflecting the evolution of the Fermi surfaces. Correspondingly, with further increase of the doping the antiferromagnetic fluctuations are suppressed for x>0.1 and the imaginary part of the spin susceptibility at antiferromagnetic wave vector becomes nearly temperature independent. At the same time, we observe that the uniform susceptibility deviates from the Pauli-like behavior and is increasing with increasing temperature reflecting the activation processes for the α-Fermi surfaces up to temperatures of about T=800 K. With increase of the doping the absolute value of the uniform susceptibility lowers and its temperature dependence changes. In particular, it is a constant at low temperatures and then decreases with increasing temperature. We discuss our results in a context of recent experimental data.

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